the transition into the subsequent glacial period at roughly 114,000 years. In past studies it has had to be assumed that deposition between these 'mile posts' has been constant, which may be so at typical open-ocean locations where deposition rates are slow. But Adkins *et al.* looked at the Bermuda Rise precisely because rates of deposition there are much greater, and undoubtedly much more variable.

To produce a timescale that accounts for such changes, they take advantage of the relative constancy in the rate of deposition of the isotope ^{230}Th in the deep sea and its unusual concentration by redeposition at the Bermuda Rise. This is a real innovation, which allows much more precise dating between the mile posts (see box). For example, the resulting, refined timescale suggests that the period during which global ice volume was comparable to or less than today's lasted from 129,000 to 119,000 years ago, or for about 10,000 years. This is 3,000 years less than implied by simple linear interpolation between mile posts. The duration of transitional events is also well constrained for the first time.

What was the ocean doing during the last interglacial? Adkins and colleagues' measurements of the cadmium/calcium ratio in benthic foraminifera (a proxy for seawater nutrient concentration) show that the ratio remained much the same as during the Holocene[6], implying that the proportion of NADW at the Bermuda Rise was similar to today's throughout the period of minimum ice volume. ^{230}Th-derived fluxes of carbonate and fine-grained detritus also remained nearly constant. These observations seem to rule out the possibility of any large swings in circulation, surface productivity and land–sea sediment transfer lasting more than a few hundred years.

The largest geochemical change in the new record is seen during the ice-sheet melting phase leading into the interglacial, when Cd/Ca ratios shot up to values usually encountered in the nutrient-rich Pacific. Similar evidence from elsewhere in the Atlantic has been taken to suggest that fresh water from rapidly melting ice sheets swamped the conveyor, stemming the flow of nutrient-poor NADW[8,9]. Adkins and co-authors' evidence for a large increase in the transfer of sediment from land to sea early in the high Cd/Ca event is strong support for this view.

Accordioning with thorium

In the work discussed here, Adkins *et al.*[1] demonstrate that measurements of ^{230}Th, a uranium decay product, can be used to account for changes in sediment deposition rate between the orbitally derived 'mile posts' for the beginning and end of the last interglacial period.

Uranium is soluble and of nearly constant concentration in sea water, whereas thorium adsorbs rapidly to sedimenting detrital particles. Decay of ^{234}U to ^{230}Th within sea water therefore produces a flux of ^{230}Th to the sea floor that depends only on water depth. After accounting for some production of ^{230}Th in sediments (from sedimentary U, which is easily measured) and some loss due to decay (^{230}Th is itself radioactive), one can back-calculate the amount of ^{230}Th at the time of deposition, which however requires independent estimates of age. These are, of course, lacking between the mile posts. But precise Th and U measurements in radiocarbon-dated Holocene sediments of the Bermuda Rise[13,14] have shown that age- and U-corrected ^{230}Th values were often considerably higher than expected solely from local seawater production, indicating that regionally deposited ^{230}Th had been swept up by bottom currents and preferentially redeposited at the Bermuda Rise.

The amount of this sediment 'focusing' can be calculated simply as the excess ^{230}Th measured and corrected for decay since the time of deposition divided by that expected from production in overlying sea water in a given increment of time[13]. At the Bermuda Rise this 'focusing factor' (*F*) varies inversely with the percentage by weight of biogenic carbonate, presumably because the same climatic forces that promote delivery of terrestrial detritus to the deep western Atlantic and, consequently, dilution of the near-constant surface production of carbonate, also act to invigorate recirculation at depth.

Whatever the cause, Adkins *et al.* realized they could estimate *F* from carbonate proxy data, and then use their ^{230}Th results to calculate the time elapsed between measurements – which in this case were made at astonishingly dense 2-cm intervals. Their technique is still heavily reliant on the accuracy of the orbitally derived mile posts, but this way of refining the timescale will be very useful even if those posts are eventually moved. **S.L.**

What has not been seen before is the evidence from the Cd/Ca ratio for a reduction in NADW flow at the end of the interglacial, just at the point where benthic ^{18}O/^{16}O ratios begin to rise. This Cd/Ca event is not large compared with the earlier one, but its significance is confirmed by an increase in carbonate dissolution, as expected if NADW gave way to a nutrient-rich, and therefore CO$_2$-rich, water mass. The detail is unprecedented and so one cannot be entirely sure that the initial oxygen-isotope changes are the first signs of irreversible ice-sheet growth (differences in temperature and ^{18}O/^{16}O ratio between water masses may factor in). But this is the simplest explanation.

If true, what caused the about-face in the climate system? There is no simple answer. But (tantalizingly) many characteristics of the terminal interglacial event recorded by Adkins *et al.* are similar to those reported[10] from the Bermuda Rise for the Little Ice Age, a 'cold snap' which occurred a few hundred years ago. Arctic field geologists have long suspected that the end of the present interglacial was then very nearly at hand, as semi-permanent snowfields threatened to coalesce over the high plateaux of Labrador and Baffin Island[11]. If the coalescence had been complete, albedo feedback along with decreasing summer insolation (on the decline locally for the past 9,000 years) might have triumphed over interglacial warmth. Numerical models suggest that such a chain of events can be unleashed with very little forcing[12].

In this context, a slight weakening of the ocean circulation can be likened to a sledgehammer blow — one which could conceivably bring the present interglacial to its knees. Such a possibility only adds to concerns about the potential impact of increased greenhouse forcing on the oceans. ☐

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